The Cork Floats Where?

Grades 4-6

Overview

The students ponder why a cork will float along the inside edge of a glass that is half-filled with water and in the very middle of a glass filled a drop over the brim. This activity's concepts are ***cohesion & adhesion***.

Objective

- The students will develop an understanding of water's cohesion and adhesion factors that determine, for example, where an object (i.e. cork) floats and how water acts.

Vocabulary

- **Meniscus:** The curved upper surface of a liquid.
- **Cohesion:** Mutual attraction by which the elements of a body (water) are held together.
- **Adhesion:** Physical attraction or joining of two substances.

Materials

For the presenter:

- a drinking glass
- one small cork (gummed reinforcements for punched paper holes work too)
- water
- eye dropper (optional, you will want to use it if you have one)

For each group of students:

- 1 small cork
- 1 eye dropper
- a glass half full of water
- a small container of water that will fill the glass up

For each student:

paper and pencil
Art Activity: ***Cork Frog or Fish***

- small cork
- 1 green pipe cleaner
- several colorful pipe cleaners
- crayons
- One - 16-inch piece of string
- colorful, square, plastic, bread tags (fins for fish)

For whole group:

- water in a large container for floating frogs and fish

Getting Ready

1. Have a glass half-filled with water and a cork next to it. Have a drawing of two empty glasses either on the blackboard or on the overhead.
2. Write the vocabulary words and their definitions on the overhead / blackboard.
3. Have art materials on a table for easy distribution.
4. Make sure each student has a piece of paper and a pencil to use.

Procedures

1. ***Focus***: Tell the students that you are going to fill your glass half full with water. Then draw the water line half way up on one of your glasses on the blackboard. Ask the students to draw a glass half-full of water on their paper. Tell them to signal you when they are finished by sitting quietly with their fist on their desk with their thumb up. Compliment certain groups or one side of the room by saying things like, "Good, this table is quiet and ready for directions. I am waiting for just a few more signals before I give the rest of my directions. Great!" Then show them the cork and explain that in a few minutes you will float the cork on the water surface, but before you do, they are to draw what they predict they will see when you do this and share their drawing with a neighbor or their table.
2. Without commenting on their placement of their corks, walk around the room observing the students' drawings of where their cork is floating. Walk to your drawing and tell the students that this is what most of their drawings showed; draw the cork floating in the middle. Ask how many of them have a similar drawing. Next ask, "How many of you are wondering what will actually happen when the cork is placed on the water surface? Let's find out!."

3. Share the objectives with the students.

4. Distribute group materials to students.

5. Float your cork on the water surface.

   Q. "Where does the cork float? ***(It should be next to the side of the glass. If it is in the middle, move it somewhat and it will go to the side.).*** Good scientist are keen observers, so listen carefully to my next question and double check your observations."

   Q. "Where is the water level highest in the half-filled glass?"

   [When the glass is half-full, the highest level is at the side or the circumference of the glass edge. This is a result of the adhesive forces between the water and the glass molecules. Since the meniscus, the curved upper surface of a liquid, is at the circumference, the cork floats there.]

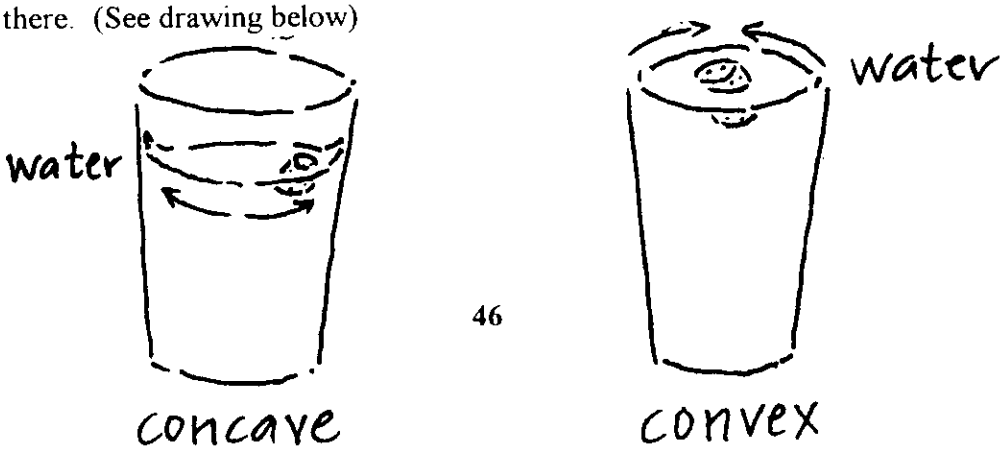
6. Now fill the glass to its brim, and if you have it, use an eye dropper to add several more drops of water. Have the students do the same, but they are **not** to float their corks yet. If you do not have an eye dropper, use your hand to shake several more drops of water until the water is slightly above the brim.

7. Ask the students to predict where the cork will float. Now float the cork. Ask the students to describe where their cork is floating. It should be floating in or near the center.

   Q. "Why is the cork is floating in the center of a full glass of water?"
   Q. "Where is the water level highest in a full glass?"
   Q. "Why is it possible to fill the glass more than full without the water overflowing?"
   Q. "What happens when you push the cork towards the edge? ***(It will not stay at the edge)"***
   Q. "Why does this happen?"

Explanation

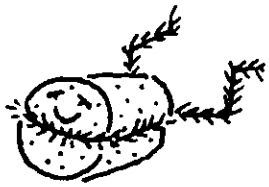
When a glass is filled to the brim with water, the surface tension and the cohesive forces between the water molecules form a film on the water surface which makes it possible to fill the glass more than full. The highest level of the meniscus is now in the center of the glass, which is why the cork floats there. (See drawing below)



Closure

Have each student draw two glasses of water with floating corks on them; one should be brim full and the other half-full. Students should be ready to explain why the corks are in the different positions in each glass. If the students are sitting in groups, have them share with each other their drawings and explanations. Then call on a few students to explain to the class.

Floating objects tend to float at the highest spots of the meniscus; consequently if a glass is half full the object ***(cork)*** will float at the side; and if the glass is filled to the brim-plus, the object ***(cork)*** will float at the center.



Art Activity: Cork Frog & Fish

Materials

For frog:

- cork (wine bottle corks work for the frog & fish)
- 1 green pipe cleaner
- one - 16-inch piece of string
- crayons **(DO NOT** use markers because the color washes off in the water)

For fish:

- teacher will need an exacto knife to cut slits for the fins.
- colorful, square, plastic, bread tags (fins)
- colorful pipe cleaners

Procedures

To Make A Frog

1. Color the cork's circular side and the narrow end with a green color crayon.
2. Draw eyes and mouth on the upper half of the large end of the cork with a black crayon.
3. Fold a green pipe cleaner in half.
4. Tie the string to the middle of the pipe cleaner at its fold.
5. Place the middle of the pipe cleaner in the middle of the large end of the cork.
6. Wrap the pipe cleaner around the sides of the cork and twist tightly together behind the small end of the cork.
7. Twist the remaining part of the cleaner at the small end into the shape of frog legs. See the drawing on the next page.)

To Make a Fish

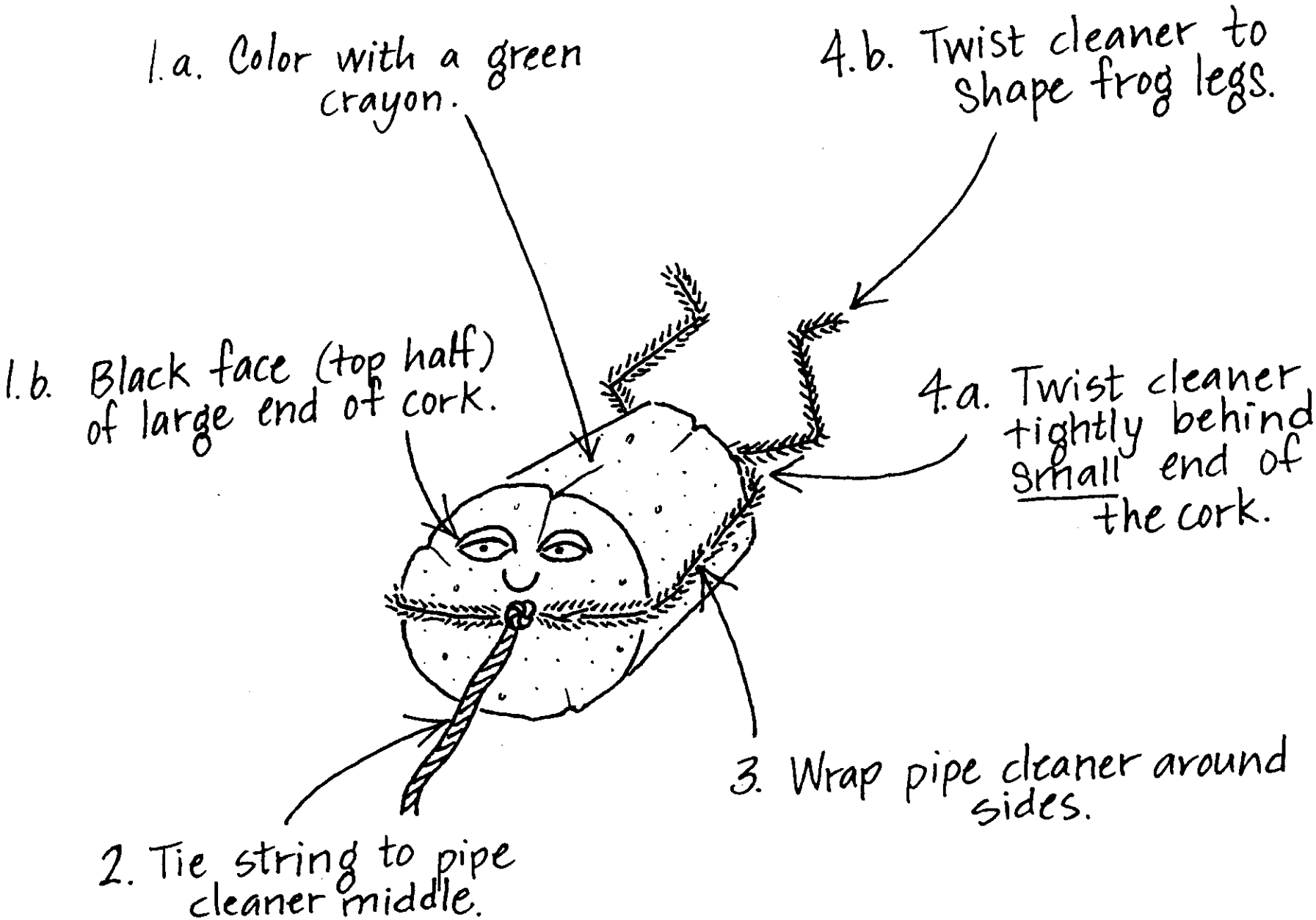
1. The teacher slits the corks with an exacto knife to slip in the plasticbread tabs.
2. Students should be CREATIVE!
3. Students design their fish on paper first.
4. After checking their drawings, have students get string, pipe cleaners, etc.

Closure for Art Activity

Float the frogs and fish in a sink or tub.

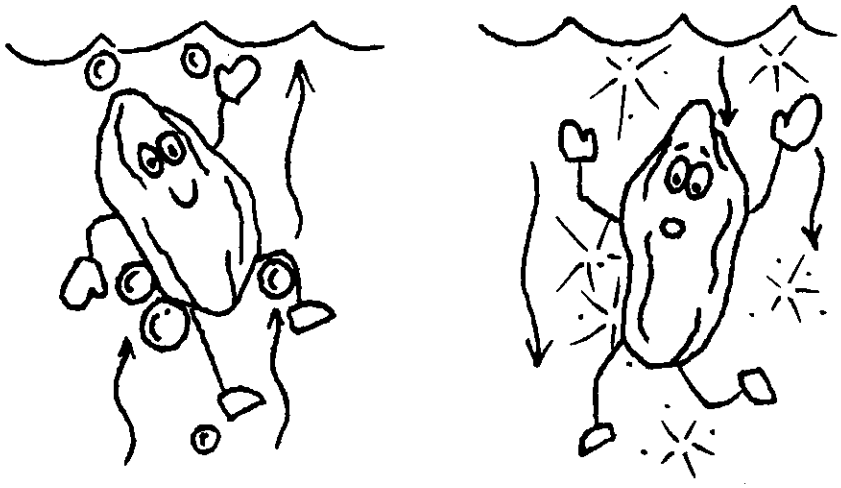
Clean Up

The last five minutes have every student work to leave the classroom as they found it.


1.a. Color with a green crayon.
4.b. Twist cleaner to shape frog legs.
1.b. Black face (top half) of large end of cork.
4.a. Twist cleaner tightly behind small end of the cork.
3. Wrap pipe cleaner around sides.
2. Tie string to pipe cleaner middle.

THE DANCING RAISINS

Grades 4-6



Overview

In this lesson, the students are learning about ***density;*** they analyze why the raisins pop up to the surface in a jar of water and then sink back down. At first they are not told that Alka Seltzer has been added to the water. The students end the lesson by drawing a cartoon of raisins explaining density as they bob up and down.

Objectives

- To help students better understand the property of density.
- To help studen understand cohesion & adhesion.

Vocabulary

Density: The amount of something per unit measure, i.e., volume. The mass per unit volume of a substance under specified conditions of temperature and pressure.

Materials

For the presenter:

Activity 1

- two narrow tall, glass jars
- twelve raisins (Six raisins for each experiment.)
- one or two Alka Seltzer tablets
- one can of 7-up for the second experiment

Activity 2

- six fresh grapes the same size
- 7-Up in a clear jar / glass from the first experiment
- water in a clear jar / glass.
- 1 Alka Seltzer tablet

For the student:

- white drawing paper for cartoon

Getting Ready

- Write the word ***density*** and its definition on the overhead / blackboard.
- Have all the materials set up on a table and ready to go.

Procedures

1. Fill one jar with water.
2. Drop tablets that produce carbon dioxide gas into the water; i.e., two Alka Seltzer tablets. (If possible do this without the students seeing you.)
3. Immediately after adding the Alka Seltzer tablets, drop the raisins into the jar.
4. Have the students observe the raisins bobbing up and down.

Questions

1. "When the raisins were dropped into the water why did they sink?"
2. "Why did some of the raisins bob up?"
3. "About how long do the raisins float at the water's surface?"
4. "Tell the class that you added the Alka Seltzer tablets and ask them why they think you did this?"
5. "Would the raisins bob up and down without the Alka Seltzer tablets?"
6. "Remind the class that they are young scientists and as young scientists they are to observe very carefully before answering the next question. What is the difference between the rising and sinking raisins?"
7. "What liquid would give off carbon dioxide bubbles by itself?"

Explanation

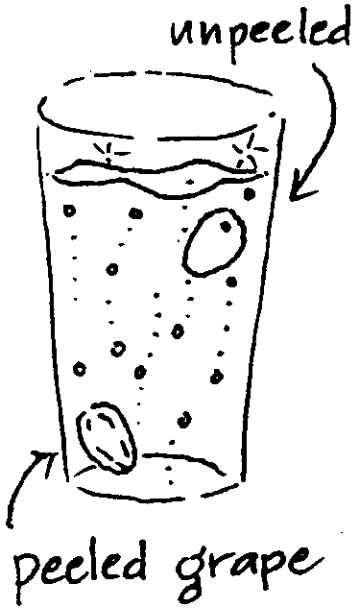
The raisins' density is a little over 1, so they sink in the water when they are first dropped into it, but then the gas bubbles from the Alka Seltzer tablets adhere to their surfaces causing the raisins to rise to the surface. The rising raisins have CO_2 bubbles attached to them, and the sinking raisins do not. When they get to the surface, the bubbles burst making them heavier than the water again, and they sink. Soda pop, like 7-up, has gas already dissolved in it, so when it is poured into a glass or jar the bubbles escape producing the same results as the Alka Seltzer tablet's bubbles.

Closure

Have a student pour a can of 7-up in another glass jar. Have other students drop six raisins into the 7-up. Have all the students team up in pairs to explain:

1. Why did the raisins first began to sink, rise to the surface, and sink again?

2. The students are to draw the jar with raisins rising and sinking. Draw cartoon raisins showing the difference in how the rising/sinking ones look. Have one that is rising and one that is sinking explaining to each other what is happening to them. The raisins must explain how changing ***density*** affects their bobbing up and down. Ask the students to be creative and give them enough time to draw. If they are sitting in groups, have the students share their cartoons first with their groups for feedback. They should make any necessary changes at this time to have accurate cartoon explanations. Then, if time permits, have one or two students from each group share their cartoon with the class.



Activity 2: The Heavier Grape - Density

Objectives

- To help students understand density.
- To help students understand cohesion and adhesion.

Materials

- 6 fresh grapes the same size
- 7-Up in a clear jar / glass from the first experiment
- water in a clear jar / glass.
- 1 Alka Seltzer tablet

Procedure

1. Show two grapes to the students.
2. Peel one grape by taking its skin off, but leave the other grape with its peeling on.
3. Again, show the two grapes to the class, but this time ask them: "Which of the two grapes is heavier, the whole grape or the peeled one?" ***(The students will usually answer correctly 'the unpeeled one)***
4. Explain to the students that you are going to drop the grapes into the 7-Up and ask the class to predict what will happen, with reasons that support their predictions.
5. Drop both of the grapes into the 7-Up and have the students observe what happens.

   Questions

   "Why does the peeled grape sink to the bottom?"
   "Which of the two grapes is lighter in weight?"
   "Why does the unpeeled grape float?"
   "Would an unpeeled grape also float in water?"
6. Show two more grapes to the students
7. Peel one grape by taking its skin off, but leave the other grape with its peeling on.
8. Explain to the students that you are going to drop the grapes into water and ask the class to predict what will happen, with reasons that support their predictions.

Questions

"What happened?"
"Why is there a difference in what happened when we dropped the grapes into 7-Up and then into water?"
"What property does the grape peel have?"

Explanation

The unpeeled grape has ***hydrophobe:*** water repelling properties; consequently, the ***carbon dioxide (CO_2)*** bubbles from the 7-Up can adhere to the unpeeled grape. The peeled grape doesn't have hydrophobe properties and the 7-Up bubbles can't adhere to it, but it is ***hydrophyl:*** water-attracting. The Alka Seltzer puts CO_2 into the water and make it like 7-Up.

Closure

Explain to the students that you are going to drop two grapes (one peeled and one whole) into water with Alka Seltzer and ask the class to predict what will happen on paper, and they must support their predictions. ***(If they understand the concepts of density, adhesion and cohesion, they will predict that the unpeeled grape will float and the peeled grape will sink.)*** Have them share their conclusion with two other students.

Oceans of Fun

Grades 4-5

Overview

In groups, the students will experiment with salt water and fresh water to see which has more buoyancy. In groups, the students will make a wave jar to observe the shapes and movement of waves.

Objectives

- To help students have a better understanding of salt water
- To help students have a better understanding of why the ocean is salty
- To help students have a better understanding of how ocean waves are formed

Materials

For the presenter:

- copy of directions
- plastic tub filled with water
- paper towels
- 4 each -- 1/4 cup & 1/2 cup measuring cups

For each group of 4 students:

- Two - 16 oz clear plastic glasses
- an egg
- tablespoon
- 1/2 cup salt
- water
- 1/2 cup of mineral oil
- 1/4 cup alcohol
- glass jar with lid
- blue food coloring
- One copy of the directions & materials sheet for experiments 1 and 2

Getting Ready

Students should be divided into groups of 4. They will need a shared work space for experiments. Place the following items in an area for easy access by students: tub of water, measuring cups, eggs, containers of salt, paper towel, mineral oil, alcohol, glasses, jars/lids, and blue food coloring.

Procedures

Activity 1: A Salty Solution & Activity 2: Making Waves

Begin by telling the students that they will be doing ocean experiments. Use the questions below to get the students interested and help you find out what they already know about fresh water, salt water and waves.

Questions

Ask the students: "Have you ever been swimming in the ocean or a lake? Is there a difference between the ocean and a lake? ***(ocean/salty, lake/fresh water)*** Can you give some examples? Do objects float better in fresh water or salt water? How do you know? Why do some things float and some sink? What is ***buoyancy?*** (write it on the board for reference later) Why is the ocean salty? What causes waves in the ocean? Have you ever observed the shape of a wave? Have you ever wondered what causes their shape?"

Discussion

As rivers flow into the ocean, they bring dissolved salt with them. You cannot taste it because there is only a very small amount of salt. The water in the ocean evaporates and the salt remains in the ocean. Over the years, the ocean gets saltier and saltier. Today, each gallon of ocean water contains approximately 1/4 pound of salt. The reason things float better in salt water is because salty water is heavier than fresh water and pushes the object towards the surface.

Wind, earthquakes and the gravitational pull of the moon and sun cause waves. The wind moves across the water and causes part of the water to rise. The wind then pushes on the raised water and creates waves. Waves have a ***crest*** and ***trough.*** (***Crest*** and ***trough*** should be written on chalkboard for reference later by students)

Tell the students that they are going to do an experiment that will test the ***buoyancy*** of salt water. They will also be creating a wave in a jar to observe the motion of waves and their shapes. Before handing out any materials, explain the steps involved in the experiments and review rules.

Rules:

- Water is for experimenting only and it should remain in jar.
- Any spills need to be cleaned up.
- Anyone not following directions will not be allowed to experiment with their group.
- Return materials to the table as you finish with them.

Experiment Steps:

1. Each group needs to choose 2 getters (pick up supplies).
2. Each group needs to choose a director (read directions).
3. Each group needs to choose a recorder.
4. Show the directions for Activity 1 and Activity 2 to the class. Go over the directions and show the students where they will find the materials that they will need for the experiment.
5. Ask if anyone has a question; if not, hand out copies of the directions for the experiments to the director of each group. When the groups are ready the getters may pick up materials on the table.
6. When they have completed Experiment 1, and you have checked their recording sheet, they may begin Experiment 2.

Discussion

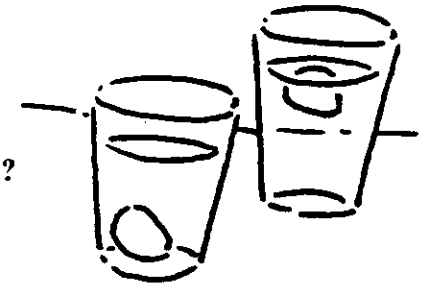
As you move around the classroom, check to see if any groups are having problems. Ask the students what they are discovering about the buoyancy of salt water, what items floated in salt water but not fresh water, and what they observed about the water. Ask them if they were able to find the crest and the trough. If time permits, have each group share with the class what they discovered.

Clean Up

Each team is responsible for cleaning up their area. The wave jars may be saved for further observation or shared with students from other classes.

Experiment 1 - A Salty Solution

(Group directions & recording sheet)



Did your team:

- **choose 2 getters that will be in charge of getting materials?**
- **choose a director that will read the experiment for your group?**
- **choose a recorder to record your groups observations and findings?**

Materials

- 2 glasses filled with water, leave about 2-3 inches at the top
- egg
- tablespoon
- 1/2 cup salt

Directions

1. Dissolve 3 or 4 tablespoons of salt in one of the glasses.
2. Place the egg in the salt water. If it does not float, add more salt until it does.
3. Now place the egg in the fresh water.
4. Record what happened.
5. Look around the room or in your desk for other items that you can test in the fresh water and salt water. (Examples: paper clip, crayon, etc.)
6. Discuss with your group why some things floated in the salt water and not in the fresh water.

----------Recording Sheet----------

Objects that float in:			**Objects that sink in:**		
Salt & Fresh Water	**Salt Water Only**	**Fresh Water Only**	**Salt & Fresh Water**	**Salt Water Only**	**Fresh Water Only**

Conclusions (what did we learn):

Experiment 2 - Making Waves

(Group direction & recording sheet)

Materials

- 1 jar with a lid
- 1/2 cup mineral oil
- 1/4 cup alcohol
- 1/4 cup water
- blue food coloring

Directions

1. Pour water into the jar.
2. Add a couple drops of blue food coloring -- enough to make it color the water.
3. Add alcohol and mineral oil.
4. Mix the ingredients in the jar.
5. Screw the lid on the jar as tight as possible.
6. Slowly move the jar in a side to side motion to make a wave. Observe what is happening to the liquid. "Can you see the ***crest*** and the ***trough***? Does the water seem to be pushed upwards? What are you doing that is like the wind on the ocean?"

----------Recording Sheet----------

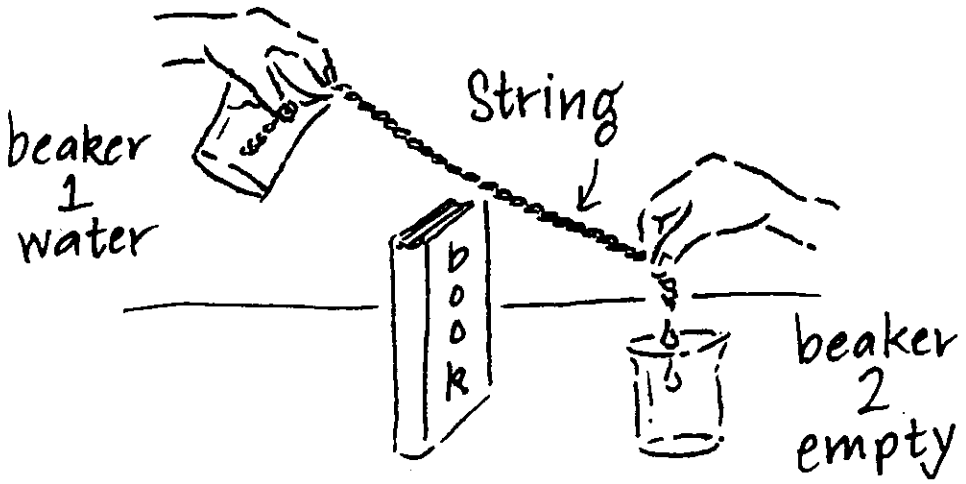
Observations

Draw a sketch of your experiment.

Conclusions(what we learned):

Water String Travels

Grades 4-6



Overview

This is a short lesson: about 30-35 minutes. The students are studying the properties of water. In this lesson the students will observe how water travels from one beaker across a wet string (20 cm) to a second empty beaker. The water molecules are attracted to the string molecules by ***adhesion.***

Objective

- To help students understand that some liquids have strong cohesive forces between their molecules.

Vocabulary

- **Cohesion:** Mutual attraction by which the elements of a body (water) are held together.
- **Adhesion**: Physical attraction or joining of two substances.

Materials

For the presenter:

- two beakers
- string (must be water absorbent)
- one book

For the students:

- paper for drawing a cartoon
- pencils

Getting Ready

Fill one of the beakers about 3/4 full with water and have it on a table on one side of an old book and the other empty beaker about 20 cm on the other side of the book. Place the string on the table in front of the beaker of water. (See drawing) Note: It is best to use an old book in case of an accident.

Procedures

1. ***Focus*** "The task is to get the water from beaker #1 to beaker #2 without moving beaker one or two to the other side of the book. **Q.** Any ideas?"
2. Share the objective at this time.
3. Wet the string thoroughly in the water in beaker #1.
4. Hold one end of the wet string into beaker #1's water and the other end over and into empty beaker #2. [See the drawing]
5. Pour the water slowly across the string.
6. Repeat steps 1-5, except this time use a ***dry*** string and be sure to have an old book or some other type of divider that you do not mind getting wet.

Questions

"What were the different results in using a wet versus a dry string?"
"Why did the string have to be wet for the water to travel on it?"
"What other materials would transfer the water instead of string? Why?"
"What other materials would not transfer the water? Why not?"
"What other liquids would or would not transfer along the string?"

Explanation

The string had to be wet so the water molecules would adhere to the string molecules. The water molecules are attracted to the string molecules by the process of ***adhesion.*** Because of the ***cohesive forces*** between like molecules of water, the water was able to cling to the water molecules on the wet string. The water in beaker #1 cannot be transferred to beaker #2 with a dry string or any other material that does not absorb water.

Other materials that are water absorbent that can be substituted for the string are: cotton, cloth, paper, wood, etc. Non water-absorbent materials like nylon or wool will not transfer the water. Other liquids that have strong cohesive forces between their molecules that can transfer like the water are vinegar, oil, syrup, etc.

Closure

Ask the students to:

1. Discuss these two questions in your groups and then draw a cartoon of water molecules talking to each other which depict their roles in this activity.

   Q. "Define the term ***"adhesion"*** and how did it work during this demonstration?"
   Q. "Can you define ***cohesion*** and explain its role in the transfer of water?"

2. Students share their cartoons with the class.

Clean Up

Each student / group participates in the clean up process; two students with the teacher's permission can hang up the cartoons.